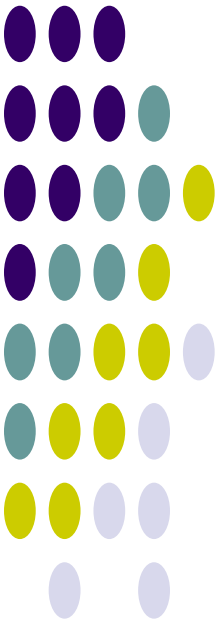
Radiation Safety Procedures for Laboratory Personnel

University of California Riverside



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POLICY

It is the policy of UCR to implement a Radiation Safety program that maintains the level of exposure to students, faculty, staff and the public "As Low As Reasonably Achievable". The purpose of the radiation safety program is to protect health and minimize the risk to life, property and the environment in the use of ionizing radiation.

INTRODUCTION

This Manual assists University personnel in using ionizing radiation in accordance with current standards of good practice, the provisions of the UCR radioactive materials license, and the relevant state and federal regulations.

A copy of the Radiation Safety Manual can be found on the UCR EH&S web site www.ehs.ucr.edu/ for use as a reference by persons involved with the project(s) that contain radiation.

The Radiation Safety Committee and the Radiation Safety Officer are authorized by the Chancellor to limit, suspend, or revoke an individual's authority to use radioactive material(s) or sources that produce radiation if such use is immediately dangerous to the life and health of individuals or violates health and safety codes.

Who is regulated?

All personnel under University auspices who use, supervise, or control radioactive materials.

Users of "Generally Licensed Materials/ Exempt Quantities", which might be acquired without a Nuclear Regulatory Commission or State of California specific license, are not exempt from the requirements of this manual.

Who is not regulated?

Individuals using generally licensed consumer products containing radioactive material (balances, static eliminators, smoke detectors, and chemical reagents containing uranium and thorium).

ORGANIZATION AND RESPONSIBILITY

Chancellor

According to the UCR Policy on Environmental Health and Safety, the Chancellor is responsible for the existence of a radiation safety program that will maintain compliance with relevant local, state, and federal regulations related to the use of ionizing radiation. The Chancellor has delegated responsibility for development/operation of the radiation safety program to the committees, departments, and individuals as stated below.

Radiation Safety Committee

The RSC is a body of faculty and other experts appointed by the Chancellor to establish policies and procedures governing the use of ionizing radiation at UCR, to maintain surveillance over activities involving them, and to report on the status of these activities to the chancellor.

Office of Environmental Health and Safety

The Office of Environmental Health and Safety (EH&S) implements the radiation safety program. This program includes surveillance of all users of radioisotopes and/or radiation-producing machines and equipment. Specific functions include: monitoring of exposure levels, investigation of incidents, safety consultation, training in radiation safety, radiation safety services, and management of radioactive wastes.

The Director of Environmental Health and Safety: Responsible for the review of UCR policies on radiation and radiation safety. The EH&S Director is an ex-officio member of the Radiation Safety Committee.

The Radiation Safety Officer Responsible for developing and operating the radiation safety program and for assuring that radiation uses are in conformance with UCR policies and applicable government regulations. The Radiation Safety Officer is also responsible for referring to the Radiation Safety Committee matters requiring its review and approval. The Radiation Safety Officer is a full voting member of the Radiation Safety Committee.

TRAINING

Policy

EH&S Radiation Safety provides radiation safety training for individuals who work with or around radioactive materials, radiation producing equipment, and moisture density gauges. Principal Investigators and workers using radioactive material must have initial training before using radioactive materials. Retraining is required every **3 years** for the worker categories mentioned above.

Worker Categories and Training Requirements

Principal Investigators

A principal investigator who wishes to use radioactive materials must have a faculty appointment. They are directly responsible for compliance with all regulations governing radiation safety in the laboratory. PIs must attend the New Radiation Laboratory Worker training class prior to applying for using radioactive materials and radiation generating machines and are subject to the same retraining requirements as radiation workers.

Radiation Workers

Personnel who work directly with radioactive material and who are listed as radiation workers under a PI. These personnel must initially train by attending the New Radiation Laboratory Worker training class before starting work in the laboratory. The annual retraining requirement can be fulfilled on the EH&S website (http://ehs.ucr.edu) under “Training.”

What if a worker leaves?

It is the responsibility of the PI to inform Radiation Safety on the Radiation Safety Monthly Report if the worker has departed the lab as well as if they have left UCR.

Procedure for Radiation Safety Initial Training

All new radiation workers should review this manual (Radiation Safety Lab User Manual), the Training Manual for Users of Radioactive Material, and the PI's RAM-use protocols before attending the Radiation Safety Initial Training class. Copies of these manuals are available on the EH&S website (http://ehs.ucr.edu). The Radiation Safety initial training class consists of sections on the fundamentals of radiation and on laboratory and control procedures specific to UCR. Each Principal Investigator is responsible for training workers under his/her supervision on radiation safety procedures and practices specific to their particular laboratory.

Procedure for Radiation Refresher Training

The radiation refresher training provides updates in Radiation Safety policies, as well as general topics of interest that are relevant to those working around radioactive materials. This training can be completed in a classroom session or on-line.

Laboratory Workers and PIs whose training is about to expire will be highlighted in bold 3 months prior to the expiration date on the Radiation Safety Monthly Report that is sent to the labs at the end of each month. Training is considered due **exactly** 3 years from your last Radiation Safety Training date. If you have not trained within 7 days after your due date, you will not longer be eligible to use radioactive material and must take Radiation Safety Initial Training.

When and where are the classes scheduled, and how do I register?

Training schedules as well as the on-line refresher training can be found on the EH&S website ((http://ehs.ucr.edu) under "Training." Special classes for large groups may be given, as needed, if prior arrangements are made. You can register for the above classes by going to the EH&S website under "Training".

What training is needed if I'm only using Radiation Producing Equipment and/or irradiators?

Individuals that are only using Radiation Producing Equipment (X-ray diffraction units, luminoscopes, accelerators, fluorescene/spectrometers, industrial radiography equipment, and electron microscopes as well as irradiators should sign up for the Initial Radiation Safety Training.

PURCHASE OF RADIOACTIVE MATERIAL

Policy

Radioactive material may be purchased only by a Principal Investigator or a designee listed in the application to use isotopes. (The instructions to obtain user status are provided in the Application for Use of Radioactive Materials for Non-Human Use, available on the EH&S website.) The Laboratory Personnel List contained in the application designates individuals who are approved to sign for isotope deliveries. All radioactive material purchases are approved by Radiation Safety after the order is entered by the purchasing agent.

The Principal Investigator must be approved to possess the isotope and activity ordered. The activity, when added to the current isotope inventory, may not exceed the PIs approved possession limit for that isotope.

All acquisitions of radioactive material from a vendor must follow the same procedures as if they were purchased. This includes replacement shipments, trial kits, and free samples.

How do I place an order for radioactive materials?

The purchasing agent for your department will enter your isotope order in the HP Assist database. The order is then reviewed by EH&S Radiation Safety to ensure that the possession limits for the university as well as the possession limit for the user is not exceeded prior to approving the order.

What if I cancel an order?

If an order is cancelled, have the Purchasing Agent call EH&S Radiation Safety.

What if I need to order an isotope, but the activity of the isotope puts the AU over their possession limit for that isotope?

Perhaps some of the inventory is waste, and a waste pick-up can be scheduled to reduce the inventory. If this is not the case and the PI needs approval to increase their possession limit for that isotope, call Radiation Safety for further information.

What if I want to purchase an isotope, but it's not on my application?

The PI must complete an Application Form for Use of Radioactive Materials for Non-Human Use, available on our website (http://ehs.ucr.edu) under "Forms/Manuals," and send it to Radiation Safety, where it will be reviewed and placed on the agenda for the next scheduled Radiation Safety Committee meeting. Please be certain that you have the forms in to the Radiation Safety Office two weeks prior to the next scheduled Committee meeting. It is also possible to order the isotope under another Principal Investigator that is authorized for that isotope and work under them until the committee approves the application.

What if I want to purchase a Sealed Source?

If you plan to purchase a sealed source, follow the same procedure used for ordering radioactive materials. Sealed sources include disc sources used for meter calibration, rod sources used as external standards for gamma counters, as well as sources contained in anti-static devices.

What if I want to purchase a Liquid Scintillation Counter?

Fax the Purchase Requisition to Radiation safety, as well as the following information when the counter arrives: Make, Model and Serial Number, as well as the isotope, reference activity, and reference date of the source contained within the counter. Also list the investigator responsible for the counter, as well as where the counter is located. This information is needed for inventory purposes, as well as to track the sealed sources on campus.

What if I want to purchase a Gamma Counter?

Fax the purchase requisition to Radiation Safety; as well as the following information when the gamma counter arrives: Make, Model and Serial Number. Also list the investigator responsible for the counter, as well as where the counter

is located. This information is needed for auditing purposes, as well as to track the gamma counters on campus.

RECEIPT OF RADIOACTIVE MATERIAL

Policy

The Principal Investigator or designee shall ensure that all radioactive material packages are inspected upon receipt for evidence of damage or breakage.

Package Receipt Check-In and Delivery

All off site shipments of radioactive materials arrive at EH&S Radiation Safety and are checked for radiation exposure and possible contamination. Damaged or contaminated packages will be held at EH&S Radiation Safety until the matter is resolved with the vendor/ shipper.

Information on the packing slip is checked against that recorded in the HP Assist database to verify that the items received are the same as those approved/ ordered. The inventory number generated by HP assist is written on the packing slip. Items that are standing orders need to be approved only prior to the initial order. A Radioisotope Use Log is generated and attached to the package.

The package is delivered to the user, who signs the package receipt log. The individual delivering the package will write the time the package was delivered.

Radiation Safety will send packing slips to Purchasing at the end of the week

What the Lab needs to do once the package arrives

- Inspect package for damage.
- Survey the stock vial, and record the results on the Radioisotope Use Log
- If damage is noted, call EH&S Radiation Safety

TRANSFER OF RADIOACTIVE MATERIALS, LSCs, AND SEALED SOURCES

Policy

Radiation Safety reviews and approves all procedures for transfer of radioactive materials, LSCs, and sealed sources to or from an AU, either on campus (internal transfer) or off campus (external transfer). Radioactive materials (stock solutions, samples, gels), LSCs, and sealed sources may not be transferred to another PI or location until this review process has been completed.

Transport of radioactive material between PIs at UCR approved for the isotope transfer shall proceed in a manner that minimizes exposures and risks from accidental release of radioactive material.

Transport of radioactive material off-campus must conform to all applicable state and Federal regulations. **Contact EH&S Radiation Safety if you plan on shipping or transporting radioactive materials off-campus.**

What if I want to transfer radioactive material to another investigator at UCR?

On-Campus Transfers

All transfers of radioactive material between laboratories must be arranged through EH&S Radiation Safety. Before initiating an internal transfer of radioactive materials, verify that the receiving AU is authorized to possess the isotope. An Internal Transfer Form must be signed by both the sending and receiving investigators as well as by Radiation Safety, **before** the transfer may proceed. A copy of the form will be returned to both investigators.

What if I want to transfer radioactive material to someone at another institution, within or outside of the United States?

Before initiating an external transfer of radioactive material, an External Transfer Form must be completed and sent to the Radiation Safety. Information provided must include the isotope, activity, and chemical form. A contact telephone and fax number of the receiving institution will help expedite the process for obtaining approval for the shipment. The shipping address of the receiving institution must also be written on the form. A copy of the form, signed by the Radiation Safety. will be returned to both PIs. **Do not** proceed with the transfer until this form approved by Radiation Safety is returned to the PI. The External Transfer Form can be found on the EH&S website (http://ehs.ucr.edu) under "Radiation Safety".

What if I'm transferring an Liquid Scintillation Counter to another investigator at UCR, or an investigator outside of UCR?

Call Radiation Safety (827-5528). Radiation Safety will ask you where the counter is going to be located, as well as the name of the investigator to whom the counter is being transferred. If the counter is being transferred to an investigator outside UCR, see the section on Safety Clearances for the paperwork that is required. Also, further documentation may be necessary from the receiving institution.

What if I'm transferring a sealed source to another investigator at UCR, or an investigator outside of UCR?

Call Radiation Safety (827-5528). Radiation Safety will ask you where the sealed source is going to be located, as well as the name of the investigator to whom the sealed source is being transferred. If the sealed source is being transferred to an investigator outside UCR, further documentation may be necessary from the receiving institution.

How do I prepare radioactive material for shipment?

Perform radiation and contamination surveys of the package prior to shipment. Radiation and contamination levels shall not exceed the following: 220 dpm/100 cm^2 (40 Bq/100 cm^2) removable contamination; 0.5 mrem/hr (0.005 mSv/hr) at any point on the external surface of the package. Although these limits apply, procedures consistent with ALARA (As Low As Reasonably Achievable), which advocate that no removable contamination exists on package exteriors, should be followed. If the dose rate of the package exceeds 0.5 mrem/hr, call the RSOF for additional labeling information.

What are the safety precautions when checking in packages?

If a package is delivered to a room that is NOT authorized to use radioactive material, it must be moved to an authorized area prior to opening the package.

Wear proper protective clothing. Examples include a buttoned lab coat, latex, vinyl, butyl, or nitrile gloves, and a body and ring badge, as needed.

Check for evidence of potential contamination, such as packages that are crushed, wet, or damaged. If there is any evidence of leakage or contamination, contact the RSOF immediately.

Open all packages containing volatile radioactive material (i.e. ^{35}S and radioiodine) in a hood approved for radioactive material use.

If there is no evidence of isotope contamination, remove and/or completely deface the trefoil warning labels before disposing of the items as non-radioactive trash.

NUCLEAR GAUGES

Policy

It is the responsibility of the PI to contact EH&S Radiation Safety regarding the requirements for use of a moisture density gauge. All moisture density gauges are leak tested semi-annually by Radiation Safety.

What are moisture density gauges and what are they used for?

Nuclear gauges measure the density and/or moisture content of soil and/or construction materials. The gauge contains either a Cs-137 or Am-241/Be sealed source. The source is sealed in a double wall, double welded stainless steel capsule.

Where are they located?

They are currently stored at EH&S Radiation Safety.

What if I want to use it?

Contact Radiation Safety at 827-5528. It is the responsibility of the PI to ensure that the following items are entered into the use log, which is located in the box containing the nuclear density gauge:

Name of the individual using the instrument, date, destination, phone number, estimated date of return, the date of return, and who returned it..

Are there training requirements?

Yes, all users must complete radiation safety initial training.

Do I need to wear a badge?

Yes. Contact EH&S Radiation Safety to obtain a badge.

What if I have to transport it off campus?

Contact Radiation Safety regarding the specific requirements.

What if the guage is lost or stolen?

EH&S Radiation Safety should be contacted I**MMEDIATELY** at 951-827-5528.

IRRADIATORS

What if I want to use an irradiator?

After completing Radiation Safety Initial Training, individuals that wish to use the irradiator have to complete a background check as well as a fingerprint check which is sent to the FBI. Once cleared by the FBI, additional training is given by EH&S Radiation Safety. Please contact EH&S Radiation Safety at 827-5528 if you wish to use the irradiator.

SURVEY METER MAINTENANCE AND CALIBRATION

Policy

Principal Investigators are responsible for ensuring that their survey meters are calibrated annually.

What type of calibration can the Radiation Safety Office do and how long does it take?

Meters are calibrated for count rate by the Senior Electronics Technician in Botany and Plant Sciences (827-5631). There is a $50 charge for this service. When a meter is brought in for calibration, the electronic linearity of the meter is checked and meter efficiencies are determined based on the isotopes used in the laboratory. This procedure generally takes five working days. Also, the meter should have properly charged batteries. The lab will be contacted when the meter has been calibrated and is ready to be picked up. It is the responsibility of the lab to pick up the meter as well as to ensure that the batteries are fully charged.

What if the meter requires dose rate calibration?

Meters requiring dose rate calibration need to be sent by the investigator to an outside vendor. If there are any doubts about where to have the meter calibrated, contact Radiation Safety prior to sending the meter to a vendor.

When do I need to bring the meter for calibration?

Before the expiration date for calibration of the meter is reached. Make sure that the survey meter's batteries are in good working order and that the meter and probe are free from contamination. If the probe is protected with paraffin or plastic caps, these must be removed prior to bringing the meter in for calibration.

What if the meter is not working?

If the meter is not functioning properly, bring the meter to the Senior Electronics Technician to be checked. Minor repairs such as loose connections or dirty battery connections can be fixed quickly. However, any meter that needs major repairs must be sent to an outside vendor. The PI is responsible for all charges incurred for repair by a commercial vendor and for commercial calibration of meters. The investigator is also responsible for having a meter available in their laboratory for survey purposes if their meter is being repaired or calibrated. EH&S Radiation Safety does not loan meters to individual laboratories.

If the meter has been calibrated by an outside vendor, does it still need to be brought in to be calibrated?

After the meter has been calibrated by an outside vendor, bring the meter AND a copy of its calibration certificates to the Senior Electronics Technician for determination of isotope efficiencies since the vendor only checks the electronic linearity of the meter.

If a new meter is purchased, what needs to be done?

If a new meter is purchased, bring it to the Senior Electronics Technician for determination of isotope efficiencies, along with a copy of the calibration certificate from the vendor.

What precautions should be taken for the survey meter?

Many labs protect the probe of the survey meter with paraffin or plastic caps. This practice is appropriate when using the meter to detect possible contamination occurring during the experiment. However, when carrying out contamination surveys, an UNSHIELDED probe shall be used.

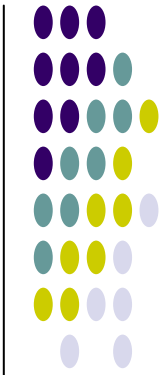
Protect the probe from contamination by avoiding contact with surfaces that may be contaminated.

Batteries in the survey meter should be checked every time the meter is used. This is generally done by turning a switch to the “BATT” position or by pressing the button labeled “Battery Check.” If the needle does not reach the “Battery OK” range, the batteries must be replaced immediately to ensure that the meter functions properly.

To prevent damage from corrosion, remove the batteries from the meter if it will not be used for an extended period.

Protect the meter from bumps and drops. The crystals in a gamma detector shatter on impact, and Geiger-Mueller probe windows can easily become damaged, releasing the gas necessary for the meter to function. Also, the electronics in the meter box can develop loose connections.

POSTING AND LABELING



Policy

All rooms and areas where regulated quantities of radioactive material are used or stored must be posted with appropriate signs and labels to inform personnel and visitors to use caution upon entering the area. A Notice to Employees (Form #RH2364) sheet must be posted so that all employees can observe and have the opportunity to read the notice on their way to or from their work area, as well as a Placard containing emergency contact information.

Where do I obtain needed labels and Forms?

All radiation labels and tape, and Notice to Employees forms can be obtained from Radiation Safety. The placard can be generated by accessing the Laboratory Safety section and clicking on E-Contact. It is the responsibility of the laboratory to keep this information current.

How, what and where do I label?

Laboratory Areas

A “Caution Radioactive Materials” label should be posted at the entrance or on the door for each area or room where licensed quantities of radioactive materials are stored or used along with a Placard containing emergency contact information.

A Notice to Employees” information sheet should be posted in an area in the main lab that is readily visible to all employees. It does not need to be posted on every room.

Refrigerators and Freezers

Refrigerators and freezers that are used to store radioactive material stock solutions and sample preparations should be prominently labeled with a “Caution Radioactive Material” sign. Refrigerators and freezers used for radioactive material storage not in a lockable lab need to be posted with an Emergency Contact Information Sheet containing a rad label along with the name of the investigators and an alternate to contact in the event of an emergency. It also should be locked, unless a secured lock-box is contained within. If a secured, internal lock-box is used, a radiation label should be placed on the outside of the

lock-box. If any sample preparations are stored inside, the isotope, total activity, and the date should be posted somewhere on the outside of the lock-box.

Waste Containers

All radioactive waste containers must be labeled with a “Caution Radioactive Material” label. The trefoil labels must be large enough and clearly visible from all sides of the waste container. A radioactive waste accumulation log indicating the isotope, activity, and the disposal date should be posted on or near the container. If the log sheet is not directly on the waste container, the isotope, waste type, and maximum activity in the waste container should be written somewhere on the container.

Small Laboratory Equipment

All trays, containers, racks, tools, etc. that are used for radioactive material experiments must be labeled with “Radioactive Material” tape.

Hallway Equipment

Equipment in hallways used with radioactive material (other than refrigerators or freezers mentioned above) must be labeled “Caution Radioactive Materials.” In addition, these items must be posted with an Emergency Contact Information Sheet listing the investigator’s name and emergency contact, after-hours telephone number.

Stock Solutions and Sample Preparations

All trays, containers, and racks that contain stock solutions of radioactive material must be labeled with “Radioactive Material” tape indicating isotope, estimated activity, and reference date if it is stored in a refrigerator or freezer. While it is not reasonable to expect that each tube or vial is labeled, each tray or rack that holds radioactive material must be labeled.

What is considered “special labeling”?

“Radiation Area” refers to any area accessible to personnel in which the radiation levels are such that a major portion of the body could receive a dose of 5 mrem or more in one hour at 30 cm, or 100 mrem in any five consecutive days.

“High Radiation Area” refers to any area accessible to personnel in which the radiation levels are such that a major portion of the body could receive a dose of 100 mrem or more in one hour at 30 cm. Ropes or fences should be used in

addition to the warning signs to clearly mark restricted areas. A locked door must be used to control access when unattended.

Please contact Radiation Safety if you feel you have any lab areas that fall under these categories.

What are the exemptions from posting and labeling?

Areas or rooms containing radioactive material for periods of less than eight hours are exempt from posting requirements if one of the following conditions is met:

- Containers are attended by an individual who takes the precautions necessary to prevent the exposure of other people (less than 2 mrem) in an hour at a distance of one foot) and does not involve the manipulation of open radioactive material; or

- Containers are in transport and are packaged and labeled in accordance with the U.S. Department of Transportation (USDOT) regulations.

INACTIVE AU STATUS, ABSENCE FROM LAB

Policy

Radiation safety has a classification of “Inactive” for laboratories that do not need to possess or use radioactive material for the foreseeable future. An inactive PI is relieved of the requirements to complete laboratory contamination surveys.

What do I need to do to become inactive?

1. Send a letter of intent to EH&S Radiation Safety. This can be either a fax or an email. It can also be indicated on the Monthly Report.
2. If you do not wish to dispose of your isotope, EH&S Radiation safety can store it for you in their facility or you can transfer it to a PI that is authorized to possess the isotope.
3. Return all personnel dosimetry to EH&S Radiation Safety.

What if I want to become active again?

A lab can be reactivated within 48 hours if the following conditions are met:

1. Send a letter to Radiation Safety requesting reactivation. This can be either a fax or an email to the Radiation Safety Officer.
2. If there have been no changes to your room maps or protocols, send an e-mail indicating there have been no changes to the Radiation Safety Officer. Otherwise, submit an updated protocol and room maps with survey locations to the Radiation Safety Officer.
3. Verify that survey meter instruments are within annual calibration.
4. Verify that radiation workers and the Principal Investigator were retrained within 3 years of their last training date.
5. Obtain required personnel dosimetry for radiation workers, and the Principal Investigator.

What if I do not have isotopes in my laboratory, but still want to retain active AU status?

The investigator should decommission the laboratory for radioactive material use. If the investigator decides to use radioactive materials, contact Radiation Safety so the room can be posted with the appropriate signage and labels.

What if I am going on sabbatical?

If you are going on sabbatical, an individual must be designated to assume responsibility for all radiation safety issues in your absence. This individual must be another PI (not a technical) preferably within the same department. Please contact the Radiation Safety Officer indicating the date you are going on sabbatical, when you will be returning, as well as the PI that will be assuming responsibility for all radiation safety issues in your absence.

RADIOACTIVE MATERIAL INCIDENT RESPONSE/REPORTING

Policy

All laboratories should have an emergency response plan appropriate for their laboratory. Each investigator is responsible for making certain that EH&S Radiation Safety (827-5528) during office hours (8:00 a.m. – 5:00 p.m.) or UCR Police (911) after hours, weekends, and holidays is called immediately in the event of:

- A major spill, theft or loss of radioactive material;
- Personnel contamination;
- Contamination outside a restricted area;
- Accidental ingestion of radioactive material; or
- Accidental disposal of radioactive material to the normal trash.

Are incident response procedures included in the Radioactive Use Application?

Yes. The investigator is required to implement incident response procedures as part of the radioactive material use application process. These procedures are included in the application packet that is given to an individual who is applying to use radioactive material. These procedures are divided into three parts: Spill, Decontamination, and Emergency Procedures. All three are included together since they are all used in responding to incidents involving radioactive material that are most likely to occur in a laboratory. Response procedures for other laboratory hazards that may be present (i.e. chemical hazards and biological pathogens) are not listed.

When do I need to call Radiation Safety?

Each PI is responsible for making certain that Radiation Safety (827-5528) during office hours (8:00 a.m. – 5:00 p.m.) or UCR Police (911)) after hours, weekends, and holidays is called immediately in the event of:

- A major spill, theft or loss of radioactive material;

- Personnel contamination;
- Contamination outside a restricted area;
- Accidental ingestion of radioactive material; or
- Accidental disposal of radioactive material to the normal trash.

The incidents listed **MUST** be reported to Radiation Safety.

What if you have a release Involving a Gas, Volatile Liquid, Dust, or a Sealed Source Rupture?

- No immediate attempt should be made to clean the spill.
- All windows should be closed, fans and air conditioners should be shut off or vents sealed, and everyone should leave the room.
- All doors should be closed, locked, and a warning sign placed at each access door.
- If powdered or gaseous sources are involved, the door and all other openings leading into the room should be sealed with wide tape (masking tape, duct tape, adhesive tape) and plastic sheeting or heavy wrapping paper.
- Minimize the spread of radioactive contamination by restricting the movements of potentially contaminated persons to a local zone just outside the “spill” area until the extent of personnel, shoe and clothing contamination is determined.
- Every person who might have been contaminated should be monitored for activity, and, if contaminated, should remove his/ her clothing and be decontaminated. If no means are available for monitoring, it should be assumed that the person is contaminated.
- The Radiation Safety Officer must be called immediately. If necessary, outside consultants experienced in radiation hazards should be called in by the Radiation Safety Officer and their advice followed.

How do I know if it is a major or minor spill and how do I make this determination?

Spill assessment considerations:

- Isotope emission characteristics
- Radioactive material volatility
- Quantity of radioactive material involved
- Size of contaminated area
- Potential for spreading contamination
- Potential dose – external and internal

Definition of Minor Spill

A spill that remains contained, that can easily and effectively be cleaned up without assistance from Radiation Safety, and that does not involve personnel contamination.

Definition of Major Spill

A spill that involves contamination of personnel or results in contamination outside of the intended work area, and that cannot be promptly cleaned up.

What if I determine that it is a minor spill?

1. Survey clothing, hands and shoes for potential personnel contamination.
2. Notify others in the area of a minor radiological spill.
3. Remove contaminated bench paper and/or gloves, and dispose of as radioactive waste.
4. Decontaminate the work area and survey to verify all contamination has been removed.
5. Document incident, attach decontamination results, and place report in the lab's recordkeeping binder.

What if I determine that it is a major spill?

1. Survey clothing, hands and shoes for potential personnel contamination.
2. Notify others in the area of a major radiological spill.
3. During business hours (weekdays 8:00 a.m. - 5:00 p.m.) call Radiation safety at 827-5528.

4. After hours (weekdays 5:00 p.m. - 8:30 a.m., weekends and holidays) call UCR Police (911) and indicate there is "**A Radiation Spill**."
5. Give them your name, the investigator's name, location, and telephone number.
6. Establish a secure boundary to prevent spreading of contamination.
7. Do not leave the area (unless in immediate danger) until initial investigations by Safety have been completed.

What if there is a Multiple Emergency?

When a radiation emergency is accompanied by other hazards (fire, explosion, chemical exposure, or other event that endangers life or property), it is important to deal first with those hazards that have the greatest potential impact. In an educational setting the quantities and types of radiation used are such that, in general, response personnel (fire and medical) can deal with severe threats to life, health, and property without concern for the radiation present if: 1) They respond with their usual personal protective equipment, and 2) Are monitored for radiation contamination and decontaminated as necessary before leaving the site of the emergency.

SECURITY OF RADIOACTIVE MATERIALS

Policy

Radioactive material shall be secured against unauthorized access or removal unless you or someone from the laboratory authorized to use the material is present.

When does radioactive material need to be secured?

If you or someone from your laboratory authorized to use radioactive material is not present.

What type of radioactive material needs to be secured?

Stock vials or stock solutions.

Does radioactive waste need to be secured?

No. Common and accepted practice is not to secure waste to the same degree as other radioactive material. However, waste is to be kept in the waste area of the laboratory and its activity sensibly minimized.

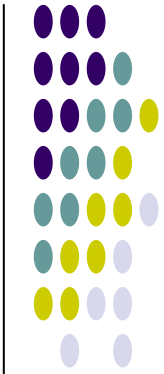
What equipment needs to be secured?

Equipment containing radioactive material (i.e. cabinets, refrigerators, freezers) that are located in hallways must be locked or contain a secured lock-box within. A refrigerator containing a secured lock-box should also have a special label posting on the outside of the refrigerator (see section on Posting and Labeling in this manual).

What if the equipment doesn't contain radioactive material?

If the labeled equipment (i.e. cabinets, refrigerators, freezers) is not being used for radioactive material, then the equipment should be decommissioned. For equipment that is used occasionally for radioactive material storage, the equipment shall be locked even if no radioactive material is currently present.

PERSONAL PROTECTIVE EQUIPMENT/ PERSONAL SAFETY



Policy

To ensure the health and safety of all members of the UCR research community.

What is Personal Protective Equipment and why is it so important?

In general, the use of Personal Protective Equipment is meant to prevent direct skin contamination and minimize the risk of internal contamination. Laboratory coats, gloves, and eye protection are the primary form of Personal Protective Equipment against contamination.

Personal Protective Equipment – When, Where and How

Eye Protection

Eye protection is required if there is risk of splash or splatter in the laboratory and where radioactive material is stored and handled. Contact lenses shall not be worn when working with volatile chemicals in the laboratory. Where there is danger of splashing or flying particles, safety goggles are mandatory.

Laboratory Coats

Laboratory coats and other Personal Protective Equipment shall be worn at all times while handling radioactive material. Laboratory coats should be fastened completely to provide complete protection.

Gloves

Selection of proper glove materials is important. Disposable gloves should be worn while handling unsealed radioactive material. Contaminated gloves must not be reused and must be disposed of as radioactive waste. Potentially contaminated gloves should not be worn when handling uncontaminated materials. **DO NOT wear gloves outside the laboratory.** All laboratory materials must be transported in a double container. The material to be transported must be in a leak-proof container that is then placed into an outer container. The surface of the secondary container must be sufficiently free of materials to be handled without the use of Personal Protective Equipment.

General safety tips that you need to follow

Food, beverages, cosmetics, medications

Federal and state laws **prohibit** storing as well as eating, drinking, chewing gum, smoking, applying cosmetics, and taking medications in **all** laboratory areas. This includes standard laboratory areas, cold rooms, warm rooms, equipment rooms, common use and other laboratory related areas. Any food, drink, and their containers found in laboratory areas will be confiscated and disposed. All food or drink used for research purposes must be labeled “NOT FOR HUMAN CONSUMPTION.”

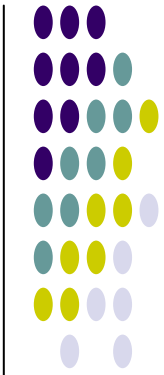
Certain hand lotions are, however, permitted. However, after this rule went into effect, it was brought to the attention of OSHA that petroleum-based hand lotions affect the integrity of latex gloves. A list of five recommended hand lotions that are non-petroleum based are recommended if you are using latex gloves in the laboratory. These five lotions are:

- Johnson and Johnson Baby Lotion
- Cetaphil
- Jason Natural Cosmetics
- Nexcare
- Keri Lotion

Clothing

Dresses, shorts, ties, or other dangling clothing should not be worn while conducting experiments in the laboratory. Open-toed shoes or sandals are not permitted in the lab.

RADIOACTIVE WASTE DISPOSAL



Policy

The investigator shall implement an effective radioactive waste management program that includes proper labeling, shielding, minimization, and assurances that disposals go into the correct radioactive waste stream.

What does the investigator need to do?

The investigator is responsible for obtaining any shielding required for his/her waste management program, as well as for maintaining written inventory records of the activity of all waste in storage and those wastes removed from the laboratory. Boxes and liners are provided by EH&S.

General waste handling procedures

Radioactive waste should be separated by type – dry solids, vials, SHARPS, liquids, and animals – and by isotope. Dual-label experiments are the only exception. **DO NOT**, under any circumstances, place radioactive waste in the hallways where housekeeping personnel might pick it up.

Liquid radioactive waste should be double-contained so that leakage from a breach in the primary container is fully contained by the secondary vessel. Also, the container should not be left open and should be capped when not in use. An Ecofunnel could be used as a substitute for a cap.

Dose rates from any radioactive waste container should not significantly exceed background radiation levels. Any container used to store radioactive waste should be prominently labeled with a radiation trefoil sign. This will alert housekeeping personnel that it is a radioactive waste container and not an ordinary trash container.

How do I schedule a waste pickup?

Before waste can be picked up from the laboratory, an on-line form as well as a “Radioactive Waste Disposal Form” with decay-corrected activities must be

completed.Contact EH&S at 827-5518 if you have any questions regarding how to fill out the form.
Disposal activity in mCi should be expressed in decimals and not exponents (i.e. if you have a .001 mCi, it should be written as .001 mCi and not $1x10^{-3}$ mCi).

Types of Radioactive Waste

Dry Waste

This category of waste consists of anything that has come into contact with radioactive material such as disposable labware, gloves, bench paper and polyacrylamide gels. The waste should be placed in a box which contains a liner.

SHARPS

SHARPS include: discarded hypodermic needles, syringes, scalpel blades; cannulas, coverslips, microscope slides, all pipettes (glass or plastic) and pipette tips, test tubes, glass Petri dishes, and other materials designed for use in biological, etiological, bacteriological or tissue culture work capable of causing puncture wounds or cuts; broken glass or any other item capable of causing puncture wounds or cuts.

Radioactive waste classified as SHARPS **MUST NOT** be mixed with dry solid materials, but must be contained in puncture-proof/rigid containers.

All contaminated SHARPS; needles, syringes and scalpel blades; and all materials designed for use in biological, etiological, bacteriological or tissue culture work capable of causing puncture wounds or cuts must be placed in red rigid SHARPS containers and marked with the isotope, activity, date of closure, and AU name.

All other SHARPS (such as broken glassware) which **are not** biologically contaminated may be discarded in red SHARPS containers OR in puncture-proof containers labeled “SHARPS” and marked with the isotope, activity, date of closure, and PI name.

Liquid Scintillation Vials

Vials containing or having contained scintillation fluids, as well as background vials. The scintillation vials should be placed in a box provided by EH&S.

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Liquid Waste

Liquid radioactive waste other than those containing iodine must be maintained at a pH between 5 and 9. Liquids containing iodine must be maintained at a pH between 7 and 9. Use only waste containers approved by EH&S that are compatable with the liquid being collected. Fill containers only to 80% of capacity. Limit sewer disposals to washings, but in no case exceed 50uCi per month.

Lead Pigs and Bricks

Lead is a regulated material and cannot be disposed of as normal trash. It must be surveyed and free of contamination before it can be picked up by EH&S. The inner lead lining of a lead pig must first be removed from the plastic container and surveyed prior to pickup. Any radiation label must be completely defaced before the plastic container is disposed as regular trash. If your laboratory has lead to pick up, indicate such on the “Radioactive Waste Disposal Form.

Uranyl Compounds

Uranyl compounds are picked up and disposed of by EH&S. This includes liquid, dry/solid waste, and uranyl acetate/nitrate in powder form. Fill out the “Radioactive Waste Disposal Form” on-line.

Sealed Sources

If you want to dispose of a sealed source, contact EH&S at 827-5518

Radioactive Animal Waste

Radioactive animal waste can include carcasses, bedding and excreta, animal blood, animal SHARPS, as well as animal waste containing etiologic agents.

Contact the EH&S at 827-5518 for instructions on how to package this type of waste

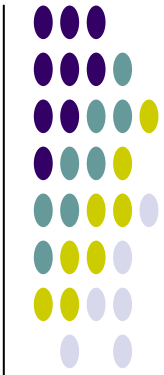
Animal SHARPS

All contaminated radiological SHARPS must be placed in a red rigid SHARPS container and held for pickup by EH&S.

Radioactive Waste Containing Infectious Material

Infectious material is defined as any materials containing animal or human bacteria, viruses, and parasites. Please contact EH&S at 827-5518 if you plan on generating this type of waste.

BIOASSAYS



Policy

Bioassays are required for employees who are likely to receive an internal, measurable radiation dose. Bioassay procedures include, but are not limited to, thyroid screening and urinalysis.

When is a bioassay required?

A bioassay is required any time more than 1 mCi of radioactive iodine in volatile form is used, or if you are using more than 10 mCi of ^{3}H. This includes opening a stock vial containing more than 1mCi of volatile radioactive iodine or 10 mCi of ^{3}H.

Radioactive iodine bioassay – what do I need to do?

Call EH&S Radiation Safety before handling more than 1 mCi of volatile radioactive iodine. If bioassays are to be performed, a baseline bioassay must be done for anyone involved in the procedure that does not have a baseline bioassay on file.

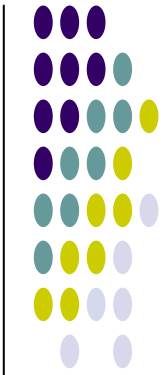
Tritium bioassay – What do I need to do?

Call EH&S Radiation Safety before handling more than 10 mCi of ^{3}H. If bioassays are to be performed, a baseline bioassay must be done for anyone involved in the procedure that does not have a baseline bioassay on file.

Are there any exceptions?

Yes. If you use tritium sources in metallic foils, you are exempt from bioassay requirements.

DOSIMETRY



Policy

Each individual likely to receive a measurable radiation dose shall wear a personal radiation dosimeter.

Who is required to wear a badge?

- Individuals using high energy beta or gamma emitters in quantities greater than 1mCi. This includes irradiator users.
- Individuals using moisture density gauges.

Who is not required to wear a badge?

- Individuals working with gas chromatographs that contain H-3 or Ni-63 sealed sources.
- Individuals working with low energy beta emitters which include C-14, S-35, H-3 and Ca-45.

Do I need a special badge if I'm working with a neutron source?

Yes. For experiments and procedures involving the use of neutron sources, personnel monitors sensitive to neutron radiation must be worn. These can be obtained by contacting Radiation Safety.

Do I need a badge if I'm working with X-ray diffraction units, accelerators, or electron microscopes?

For users of X-ray equipment, accelerators, electron microscopes, and X-ray diffraction units, see the Radiation Producing Equipment Manual for badge requirements. The manual is available on the EH&S website (http://ehs.ucr.edu) under "Forms/Manuals."

What if I'm pregnant or think I might be?

Any radiation worker who is pregnant or thinks she might be pregnant may declare herself a "Pregnant Worker" by completing a "Declaration of Pregnancy Form" and sending it to Radiation Safety. Declaration of pregnancy is voluntary. Counseling will be provided and an additional dosimeter will be issued which is read every month. This additional fetal badge is worn such that any dose to the developing baby is conservatively measured. The "Declaration of Pregnancy Form" can be found on the EH&S website (http://ehs.ucr.edu) under "Forms".

Where can I get a badge?

Badges can be obtained through EH&S Radiation Safety. You can request one on-line by accessing EH&S website (http://ehs.ucr.edu) under Radiation Safety Forms.

How often are badges exchanged, and what is the procedure for exchanging a badge?

Badges exchanged monthly include:

- Fetal badges
- Badges of individuals using high energy beta or gamma emitter in quantities greater than 1mCi.
- Individuals using moisture density gauges
- Users of x-ray units or dental x-ray machines

Badges exchanged quarterly include:

- Irradiator users
- Any individual issued a badge that is not included in the monthly category

Badges are received at EH&S Radiation Safety and are mailed to the laboratory contact for each laboratory. Old badges can be returned either in person or by campus mail. The badges are then sent to Mirion Technologies PO BOX 20889, Fountain Valley Ca 92728 for analysis. All dosimetry reports are reviewed by the Radiation Safety Officer and kept in a secure file in EH&S Radiation safety.

What if my badge is lost or damaged?

Report lost or damaged badges (crushed, broken, melted, washed, accidentally exposed, contaminated, heated in any way, etc.) to Radiation Safety as soon as you are aware of the situation so that a new badge can be issued.

How should I properly use and care for my dosimeters?

- The whole body badge shall be worn between the neck and waist. If, however one area of the body is more likely to be exposed than the rest, the badge should be worn in that area.
- The front of the badge must be exposed toward the source of radiation with no obstruction such that it correctly samples the actual exposure of the radiation worker.
- The badge shall be worn outside of any Personal Protective Equipment.
- Extremity badges (ring badges) should be worn under any protective gloves, on the hand most likely to receive the greatest exposure. The front of the ring badge should face toward the radiation source.
- Badges are issued to a single user and shall not be shared.
- Store the badge in a radiation-free area, such as a desk drawer, when not in use. Do not take the dosimeter home.

When do I need a pocket dosimeter?

- Whenever a person attempts a new procedure where the radiation exposure to personnel has not been established (to establish a procedure that will minimize personnel exposure).

- Whenever a person engages in a procedure involving radiation exposure levels that could potentially cause an over-exposure.

Except for visitors, any person required to wear a pocket dosimeter must also wear a film badge. If use of a pocket dosimeter is required as a condition of the approval, it must be calibrated appropriately (contact EH&S Radiation Safety for details) and it's reading must be recorded along with the date of the readings and the specific use of the dosimeter.

Can I request my dose record?

Yes, you can request your dose record at any time by contacting EH&S Radiation Safety.

DECOMMISSIONING EQUIPMENT OR ROOMS

Policy

PIs or laboratory personnel needing to have equipment or laboratory areas cleared for maintenance or disposal must contact EH&S prior to the equipment leaving the lab or if any maintenance work needs to be done in laboratory areas. EH&S will respond to this request to ensure no potential radiological or biological/ pathogenic contamination exists to the equipment or specified lab area.

How do I dispose equipment that was used for radioactive material?

Contact EH&S at 827-5528. The lab will be given specific instructions on cleaning of the equipment for radiological, as well as biological/chemical contamination. If you are disposing of a liquid scintillation counter, the manufacturer should be contacted to arrange for removal of the sealed source. Please contact Radiation Safety prior to disposing of a liquid scintillation counter.

What do I do if equipment that is used for radioactive material breaks and I need to have it repaired or have it serviced in the lab?

Contact EH&S at 827-5528. The lab will be given specific instructions on cleaning of the equipment for radiological, as well as biological/chemical contamination. Any radiation label on the equipment will be removed by Radiation Safety once it has been surveyed and the survey verifies the equipment is free of contamination. If the equipment is found to be contaminated, the lab will be responsible for decontaminating it. Fixed contamination will be dealt with as deemed appropriate by the Radiation Safety Office, as well as the manufacturer's requirements.

What if a piece of equipment or a lab is no longer used for radioactive material, or I want to move a piece of equipment labeled as radioactive into a lab not used for radioactive material use?

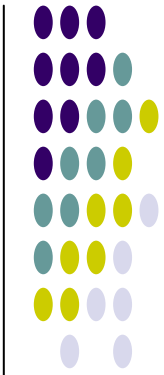
The Radiation Safety Office will ask the lab to perform a contamination survey on the equipment and to fax them the results (827-5122). Upon review of the results, which verify there is no contamination, Radiation Safety will notify the lab that they are permitted to remove the radiation label on the equipment. If there is

contamination, the lab is required to decontaminate the equipment, resurvey, and fax the results to Radiation Safety.

What if I want to decommission my laboratory areas?

Contact Radiation Safety at 825-5528 or by e-mail indicating that you wish to decommission your laboratory. A survey should be completed by the laboratory and faxed to Radiation Safety at 827-5122. A representative from Radiation safety will conduct a final decommissioning survey. If your laboratory is relocating to another area, radiation safety will not decommission the area until all of the items in the room have been removed. Do not remove any postings until you receive a call from Radiation Safety.

LABORATORY CONTAMINATION SURVEYS/ DECONTAMINATION GUIDELINES



Policy

Investigator shall perform contamination surveys and document the results in appropriate units for all areas where radioactive material is used or stored under their supervision. Radiation Safety will conduct periodic surveys and compliance reviews to assure proper use of all radioactive material, as well as assist laboratory personnel on how to perform decontamination procedures.

When do I need to perform laboratory surveys?

Any laboratory actively using radioactive material is required to perform and document a contamination survey after each experiment and also perform a monthly survey.

What if I have isotopes in storage but do not actively use them?

A number of laboratories contain radioactive material, but do not actively use it. They are still required to perform a monthly radiation survey.

What if I do not have isotopes in my laboratory, but still want to remain as an active user?

No survey is required.

What documentation do I need?

Survey documentation shall include meter efficiencies and confirm that limits for removable contamination or restricted area exposure rates are not exceeded (see the “Posting and Labeling” section of this manual for definitions of restricted areas). All records require both count rate measurements with an appropriate, calibrated survey meter and wipe tests performed to identify removable contamination. If your laboratory uses only ^{3}H, only a wipe test needs to be performed. Attach the wipe test results to the room survey map.

What items do I need before I perform a contamination survey?

These procedures are intended as a guideline for performing a standard lab survey, and may vary from lab to lab.

Gather all necessary items, including:

- A map of the survey area for marking locations of probe readings and wipe locations.
- An appropriate, calibrated meter.
- Material for performing the wipe test, such as cotton swabs, tissue, or filter paper.
- Vials in which to place the wipes.
- Tweezers to allow handling of the wipes without cross-contaminating the samples.

Should I perform a meter survey, a wipe test, or both?

The following chart was created to assist you in selecting the best method and instrument for performing contamination surveys:

Nuclide	Radiation Emitter	Energy, keV	Contamination Survey Technique *
^{14}C	β (beta)	156	WL + SG
^{36}Cl	β	714	WG + SG
^{51}Cr	γ (gamma)	320	WL + SN
^{3}H	β	18.6	WL
^{125}I	γ	35	WL + SN
^{22}Na	β/γ/γ	545/1275/511	WG + SG
^{32}P	β	1710	WG + SG
^{33}P	β	248	WL + SG
^{86}Rb	β/γ	1780/1078	WG + SG
^{35}S	β	167	WL + SG

* See key below

W = WIPE to check for removable contamination
S = SURVEY with meter (Geiger-Mueller (GM) or Sodium Iodide (NaI)) for fixed contamination
L = run on LSC
G = use GM or "sandwich" probe
N = use NaI or "sandwich" probe

Example: "WL + SG" means to perform a smear to wipe the surface and count the smear with a liquid scintillation counter, plus perform a meter survey for fixed contamination using a GM probe.

When checking for removable contamination, you always perform a wipe. When checking for fixed contamination, you measure the total radiation from the surface with a hand-held instrument then subtract the removable component from this, if appropriate.

The sandwich probe (beta-gamma sandwich detector) combines a plastic scintillator to detect beta with a Sodium Iodide crystal to detect gamma. The Ludlum Model 44-21 is the common model used at the University.

How do I perform a meter survey?

When surveying a lab with a survey meter, concentrate on regions where radioactive material has been used. Do not overlook areas where radiation users may have inadvertently walked or items that they may have touched. Hold the meter as close to the surface as possible without touching it to avoid contaminating the meter. Move the meter slowly and deliberately along lab benches, near selected floor regions, radioactive material work areas, all small equipment, sinks, refrigerators and freezers, telephones, light switches and doorknobs. Also pay close attention to laboratory coats, waste areas, and containers for both radioactive and normal trash.

All meter surveys should be performed with an unshielded probe. Meter surveys performed with a probe covered with parafilm, saran wrap, or a meter cap will not be valid. Probe efficiencies are calculated using an unshielded probe.

What do I need to write down?

Record the Make, Model, Serial Number, and calibration date of the survey meter on your survey sheet. Record the count rates in counts per minute (cpm) for all locations on the survey data sheet. Convert all count rates from cpm to disintegrations per minute (dpm). The isotope efficiencies, can be found on the calibration sticker that is attached to your meter. Identify those areas which show count rates >220 dpm after background subtraction. Also record next to the count rate the isotope that caused the contamination, decontaminate that area, re-wipe, and attach the results to the original survey.

How do I perform a wipe test?

Perform a wipe test of the laboratory, including the areas indicated previously. Also, take wipes of regions where high counts were found with the survey meter. Wipes may be wetted with alcohol or distilled water to increase the “lifting” ability. Typical wipe tests should be performed over a 100 cm^2 area.

What do I need to write down?

Record on the room map the locations of the wipe tests and the area wiped. Take wipes of broader areas initially but remember that for determination of contamination, smaller wipes should be taken as well. Load wipes in the appropriate radioactivity counter (liquid scintillation counter for beta emitters and a gamma counter for gamma emitters). All results must be converted to units of dpm per 100 cm^2 or in µCi/100 cm^2. It is understood that this represents net dpm (i.e. that background has been subtracted). If your radioactivity counter is not programmed to convert cpm to dpm, refer to the manual that is provided with the counter for the isotope efficiencies, and record them on your survey sheet.

A blank consisting of a clean wipe along with the same volume of scintillation fluid used for your sample wipes should be run along with your wipe samples.

If the results verify there is contamination (>220 dpm), record the isotope that caused the contamination, decontaminate that area, re-wipe, and attach the results to the original survey.

Can I use my survey meter to run my wipes instead of an Liquid Scintillation Counter?

If your lab uses only ^{32}P, ^{22}Na, ^{36}Cl, or ^{86}Rb, a survey meter can be used to count your wipes. However, if you use ^{32}P, ^{22}Na, ^{36}Cl, or ^{86}Rb in addition to other isotopes, you must use the LSC. If you use a portable survey meter, record the Make, Model, Serial Number, and its calibration date on the survey sheet. Record the count rates in cpm for all locations on the survey data sheet. Convert cpm to dpm. The cpm to dpm calculation, as well as the isotope efficiencies, can be found on the tag that is attached to your meter. Identify those areas which show count rates >220 dpm after background subtraction. Also record next to the count rate the isotope that caused the contamination, decontaminate that area, re-wipe, and attach the results to the original survey.

What is fixed contamination and how do I know?

Fixed, or non-removable, contamination is when radioactive material has been absorbed into a material and can only be detected by a survey meter. A wipe test will not pick up this type of contamination.

How do I Convert CPM to DPM?

- Record your survey result in CPM
- Record a background reading for your instrument(for a survey meter, this should be outside the laboratory area, for a scintillation counter, place a vial containing scintillation fluid only in your vial rack)
- Note the efficiency for the isotope that you are using
- To convert to DPM: CPM of area-Background CPM/ Decimal efficiency

Example: You just finished an experiment with P-32 and are surveying your area. The P-32 efficiency for your meter is 50%

CPM of area= 550CPM
Background CPM= 50CPM

550-50/.5= 1000DPM (This number should be recorded on your survey sheet)
If the result is >220DPM, the area should be decontaminated and the area re-surveyed.

Decontamination Procedures: How do I do it?

Floor Decontamination

- Put on appropriate PPE (double gloves, booties, lab coat, goggles) before entering areas where there may be contamination.
- Define the outer boundary of the contaminated area and mark off with tape.
- Clean from the outer edge of the contamination and work inward.
- Use a spray solution and wipe up with paper towels or other absorbent material to remove as much removable contamination as possible.
- Low activity spills not containing hazardous materials can be cleaned up by using soap and water. Take a 1ml sample of the waste water. If it is radioactive, it must be disposed as liquid radioactive waste.
- While cleaning towards the center area, check newly cleaned areas for loose contamination before walking or kneeling in these areas. Bench paper may be placed over these areas to prevent recontamination.
- Tape off and shield any areas where the contamination cannot be easily removed for further decontamination efforts.
- Re-survey area.

- Wash until removable contamination is gone.
- When wipe tests confirm only fixed contamination remains, appropriately shield the contaminated area and label with isotope, activity and date.
- Document that the area has been decontaminated and place in the lab notebook along with the initial survey.

Equipment Decontamination

- Use a spray solution and wipe up with paper towels or other absorbent material to remove as much removable contamination as possible. Be cautious not to flood the area with cleanser since it will wash the contamination into cracks, which will be difficult to decontaminate.
- Low activity spills not containing hazardous materials can be cleaned up by using soap and water. Take a 1ml sample of the waste water. If it is radioactive, it must be disposed as liquid radioactive waste.
- Wash until removable contamination is gone.
- Re-survey the equipment.
- Wash until removable contamination is gone.
- When wipe tests confirm only fixed contamination remains, appropriately shield the contaminated area and label with isotope, activity and date.
- Document that the area has been decontaminated and place in the lab notebook along with the initial survey.

Chemical Hood Decontamination

- Ensure that the chemical hood is running.
- Remove items from the hood and place them on clean bench paper outside of the hood, segregating contaminated items.
- **Volatile isotopes should be placed into bags and sealed before removing them from the hood.**
- Cut out and remove contaminated bench paper from the hood and remove the remaining bench paper. Place contaminated paper with dry rad waste.
- Check floor area for contamination from transporting contaminated items.
- Low activity spills not containing hazardous materials can be cleaned up by using soap and water. Take a 1ml sample of the waste water. If it is radioactive, it must be disposed as liquid radioactive waste..
- Re-survey the chemical hood. Check the backside of the hood sash, as well as the walls of the hood for additional contamination.
- Wash until removable contamination is gone.
- When wipe tests confirm only fixed contamination remains, appropriately shield the contaminated area and label with isotope, activity and date. Short-lived isotopes may be left for decay; long-lived isotopes may require destructive removal and replacement by the EH&S Radiation Safety.
- Document that the area has been decontaminated and place in the lab notebook along with the initial survey.

Clothing Decontamination

- Remove the contaminated clothing carefully to avoid or minimize contaminating your skin.
- Check your skin for possible contamination. Decontaminate the skin as indicated below before continuing with clothing decontamination.
- Determine approximate activity on the clothing.
- If clothing contamination is less than the daily sewer disposal limit, wash the clothing with soap and water in the sink, recording the sewer disposal activity.
- Re-survey the clothing.
- If the clothing contamination is more than the daily sewer disposal limit and cannot be easily cleaned, the clothing will have to be held for decay or disposed as radioactive waste.

Skin Decontamination

- Have someone in the lab contact Radiation Safety
- Wash contaminated area with mild soap and rinse with running tepid water (or wetted towels).
- Do not abrade or scrub the skin.
- Survey after each washing and drying for cleaning efficiency.
- When washing with soap and water no longer reduces the contamination, record the remaining activity on the skin and apply lotion to keep the skin moist and help loosen the contamination. Apply a bandage over the area to sweat out contamination. Monitor the area each day until the contamination is gone. Survey the bandage and dispose of it as RAM waste, if necessary.

RECORD KEEPING AND AUDITS

Policy

Record retention must conform to all applicable Federal and state regulations. Records must be kept up-to-date and be readily available for inspection by University Administration, Federal, and state regulatory authorities. It must be possible from the documentation to establish that all conditions for the safe use of radioactive material has been met.

What is a laboratory notebook, and what should I put in it?

Laboratory Notebook
Each user must maintain records in a notebook (3-ring binder). The notebook is a necessary part of the records required by State regulations. It must be available for review by EH&S Radiation Safety and State Inspectors. It must contain the following information:

- Copies of the original application and authorization
- Radioisotope Authorization Update forms
- Monthly Reports
- Radioisotope use logs
- Room Surveys
- Documentation of training provided in the laboratory to lab personnel.
- Dosimetry Records
- Radioactive waste disposals.

Why do I need to keep these records?

Records must be kept up-to-date and be readily available for inspection by the University Administration, Federal, and state regulatory authorities, as well as EH&S Radiation Safety.

How long do I need to keep these records?

Records of the above items must be maintained until the appropriate Federal and state regulatory agencies terminate the University's radioactive material license.

What is a Radiation Safety Audit?

An audit is performed for each PI four times per year and consists of two parts: A survey of all rooms that are surveyed by that AU, as well as an audit of all laboratory records. This includes contamination surveys, package receipts, waste disposal records, isotope inventories, survey meter calibration, personnel status and training, and inventory of sealed sources. A copy of the compliance review is then mailed to the PI.

What is checked during an audit?

The audit form is divided into 3 areas; Contamination-Related Findings, Laboratory Practice-Related Findings, and Labeling/Record-related findings.

What if the auditor finds a problem and what happens next?

A problem (deficiency) will generally be identified by a member of Radiation Safety during a routine laboratory audit.
A point system was developed based on the deficiency as well as three action levels based on the number of points that are accumulated during a calendar year. The point values for the individual deficiencies as well as the action levels and associated corrective actions are listed below for the radiation safety program:

Deficiencies assigned a point value of 1:

- "General Rules for the Safe Use of Radioactive Material" not posted
- "Emergency Response Plan for Spill or Release of Radioactive Material" not posted
- "Caution Radioactive Material" sign not posted
- Copy of Authorization, Radiation Safety Manual, and Radiation Workers guide
- Waste disposal records not maintained

- Dosimetry reports not available

Deficiencies assigned a point value of 2:

- Meter Calibration not current
- Failure to return dosimetry badges within 1 week
- Radioactive label found in ordinary trash
- Unlabelled waste, use, or storage area

Deficiencies assigned a point value of 3:

- Monthly contamination surveys not performed or recorded
- Radioactive Use logs not maintained
- Radioactive waste incorrectly labeled or stored
- Personal Protective Equipment not used while working with radioactive material
- Radioactive waste incorrectly labeled or stored

Deficiencies assigned a point value of 4:

- Excessive or unidentified contamination in controlled areas
- High exposure rate (>2mR/hr in an uncontrolled area)
- Individuals working with radioactive materials not trained
- Individuals working with radioactive materials that are more than 30 days overdue for training **(Please note that any individual that is more than 60 days overdue for training will have to repeat the new lab worker training class**)

Deficiencies assigned a point value of 5:

- Excessive or unidentified contamination in controlled areas
- Evidence of food, cosmetics or smoking in a laboratory
- Radioactive material used or stored in unauthorized areas
- Radioactive material found in ordinary trash
- Radioactive material not secured

Action Level I (Less than or equal to 10 points during 12 months)

- A written notice is sent to the Principal Investigator.

- Receipt of a written notice to EH&S Radiation Safety from the Principal Investigator within 30 days indicating that the deficiencies have been corrected.

Action Level II (Twenty points during 12 months)

- Written notice to PI, Department Chair, and Chair of the Radiation Safety Committee that Radiation Use Authorization will be suspended unless the deficiencies are corrected within 30 days of receipt of the written notice.

Action Level III (Greater than or equal to twenty points during 12 months)

- Written notice to Principal Investigator, Department Chair, and Chair of the Radiation Safety Committee that authorization to use radioactive materials has been suspended.

- PI must correct deficiencies and submit a written request to the Radiation Safety Committee.

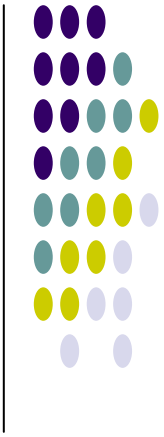
What if the auditor finds the same problem at the next audit?

If the same deficiency is found during a subsequent audit, the point value for that deficiency is doubled. Also, if the deficiency is not corrected within 30 days of the written notice to the Primary Investigator, the points that are accumulated are doubled. We provide each Primary Investigator with a copy of the compliance review sheet following each audit inspection, even if deficiencies are not identified.

What is the Monthly Report?

The monthly report is a document that is sent out at the beginning of the month to each Primary Investigator. It lists all of the individuals in the laboratory, their training dates, and current isotope inventory and room survey status. The Primary Investigator or his designee should update the form and return it to EH&S Radiation Safety by the end of the month.

URANYL ACETATE



Policy

Uranyl acetate is not regulated as radioactive material, but must be disposed as waste by EH&S.

Description of Uranyl Acetate

Uranyl acetate is a naturally occurring radioactive material that emits alpha (α), beta (β) and gamma (γ) radiation. It is used as a stain for electron microscopy viewing enhancement. Although the radiation associated with the material is far less hazardous than its chemical toxicity, it should be treated as a radioactive hazard.

What about external dose?

One hundred grams of uranyl acetate powder has a maximum unshielded dose rate of 0.6 mrem/hr.

Assume you are at 10 cm from this source and working with 25 grams. The maximum dose would be 150µrem/hr. At 1 meter, the dose rate would be 1.5µrem/hr. Background radiation is about 1000 µrem/day, or 42µrem/hr. Therefore, distance exposure at 1 meter from 25 grams gives about 4% of natural background.

What about skin dose?

Uranyl acetate will give a skin dose rate of 6.7 mrem/hr per µCi/cm^2. The activity of 1 gram of uranyl acetate is 2 µCi/g. If one gram were spread over 100 square centimeters, the contact dose rate would be 134 µrem/hr. This is a very low dose rate. Wearing laboratory gloves will provide adequate protection.

What is the external radiological hazard from uranyl acetate?

The gamma dose at 10 cm from 25 grams is ≤150 μrem/hr. So you would have to stay in this radiation field for 667 hours before reaching the public exposure limit of 100 mrem in a year. Skin/finger dose is also low. Assume 1/50 of the allowed extremity occupational exposure value of 50,000 mrem. You would have to have your fingers touching the material for 75 hours to obtain this 1000 mrem dose limit.

What is the internal radiological hazard from uranyl acetate?

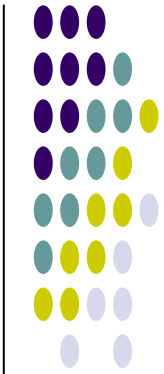
The stochastic annual limit of intake is 10 μCi. Don't inhale or ingest it. Use it in a chemical hood. Chemical safety procedures will suffice. Follow the safety procedures from the Material Safety Data Sheet (MSDS) for uranyl acetate.

Regulatory References for this manual

17CCR, Division 1, Subchapter 4
10CFR Part 19 and Part 20
NRC Regulatory Guide 8.20 Application of Bioassay for I-15-I131
NRC Regulatory Guide 8.32, Criteria for Establishing a Tritium Bioassay
NRC Regulatory Guide 8.23, Radiation Safety at Medical Institutions
UCR Broadscope License
"Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM via NRC NUREG-1575, EPA 402-R-97-016)

ISOTOPE AND SHIELDING REQUIREMENTS

The following chart is meant as a general guide only. Please call the Radiation Safety Office (827-5528) or consult the information sheet that comes with the isotope should you require further information on the specific thickness of the shielding that is required.



Isotope	Energy	Shielding
^{45}Ca	0.257 Mev beta	None
^{51}Cr	0.320 Mev gamma	Lead
^{14}C	0.156 MeV beta	None
^{36}Cl	0.710 MeV beta	Lucite
^{125}I	0.035 MeV gamma/X-ray	Lead
^{32}P	1.71 MeV beta	Lucite
^{33}P	0.249 MeV beta	None
^{22}Na	1.275 MeV gamma 0.546 MeV position	Lead
Tc-99m	0.141 MeV gamma	Lead
^{3}H	0.019 MeV beta	None
^{35}S	0.167 MeV beta	None
^{86}Rb	1.77 MeV beta 1.077 MeV gamma	Lucite first, then lead